REMARKS

The Official Action dated June 19, 2002 has been carefully considered. Accordingly, the changes presented herewith, taken with the following remarks, are believed sufficient to place the present application in condition for allowance. Reconsideration is respectfully requested.

By this amendment, the claims are amended for various matters of form and clarity. Support for the amendments to claims 1 and 3 is found in the specification at page 11, line 2, through page 12, line 14. It is believe that these changes do not involve any introduction of new matter, whereby entry is believed to be in order and is respectfully requested.

In the Official Action, the Examiner objected to the drawings as not showing the methods disclosed in claims 10-20. This objection is traversed. Claims 10-20 have been amended to remove any method steps, and thus this objection has been overcome. Reconsideration is respectfully requested.

Claims 5, 6, 12, 13, 15-20, 23 and 27 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. By present amendment, claims 5, 6, 12, 13, 15-20, 23 and 27 have been amended to address the issues raised by the Examiner. Applicants submit that the claims are definite in accord with the requirements of 35 U.S.C. § 112, second paragraph, and that the rejection has been overcome. Reconsideration is respectfully requested.

Claims 1, 3, 6, 7, 21 and 23 were rejected under 35 U.S.C. § 102(b) as being anticipated by Kawamura (U.S. Patent No. 4,951,769). The Examiner asserted that Kawamura discloses a first and second wheel with a first and second motor mechanically connected, a generator, an engine, a battery, and an inverter.

This rejection is traversed. Claim 1 recites a generator, an engine, a batter, an inverter, and a first wheel mechanically connected to a first high-efficiency switched reluctance electric motor or a brush-less DC motor, thus overcoming the rejection. Similarly, claim 3 recites the elements of claim 1 with the addition of a second wheel mechanically connected to a second

high-efficiency switched reluctance electric motor or a brush-less DC motor. Applicants find no teaching by Kawamura of a first or second high-efficiency switched reluctance electric motor or a brush-less DC motor. These amendments traverse the rejection with regard to claims 6, 7, 21 and 23 as well. Reconsideration is respectfully requested.

Claims 5, 8, 9, 22 and 27 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kawamura in view of Deguchi et al. (U.S. Patent No. 6,278,915). The Examiner asserted that Kawamura discloses a first and second wheel with a first and second motor mechanically connected, a generator, an engine, a battery, and an inverter. The Examiner noted that Kawamura did not disclose a reduction gear between the wheels and the motor. The Examiner asserted that Deguchi et al. discloses a gearbox between a motor and a wheel, and that both Deguchi et al. and Kawamura inherently disclose a belt system between the engine and the generator.

This rejection is traversed. Applicants find no teaching or suggestion by Deguchi et al. of a drive system as presently claimed, including a first motor which is a high-efficiency switched reluctance electric motor or a brush-less DC motor, Thus, claims 5, 8, 9, 22 and 27, which depend from claim 1, are clearly distinguishable from both Kawamura and Deguchi et al. Furthermore, as set forth in detail below, it is submitted that the elements of the invention as decribed in claims 5 and 27 are nonobvious over and patentably distinguishable from Kawamura even in further combination with Deguchi et al. Accordingly, this rejection is traversed and reconsideration is respectfully requested.

The Official Action does not explain the rejection with regard to claim 5, or cite any particular part of Kawamura or Deguchi et al. that teaches or suggests claim 5. Claim 5 specifies that the internal combustion engine is run continually at maximum torque. Applicants find no teaching by Kawamura or Deguchi et al. of an internal combustion engine running continually at maximum torque. Thus, the rejection has been overcome, and reconsideration is respectfully requested.

The Official Action also does not explain the rejection with regard to claim 27, or cite any particular part of Kawamura or Deguchi et al. that teaches or suggests claim 27. Claim 27 is amended to specify that the external auxiliary power output from the inverter is not provided when the mower is moving, as a safety feature of the present invention. Applicant finds no teaching by Kawamura or Deguchi et al. of this element. Thus, the rejection has been overcome, and reconsideration is respectfully requested.

Claim 24 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kawamura in view of Deguchi et al. as applied to claim 23, and further in view of Davis (U.S. Patent No. 4,992,920). The Examiner asserted that all of the elements with regard to the combined drive system of claim 23 were disclosed by Kawamura in view of Deguchi et al., but noted that Kawamura and Deguchi et al. failed to disclose using an H-bridge. The Examiner asserted that Davis discloses an H-bridge and a low pass filter.

This rejection is traversed. Claims 23 and 24 depend from claim 1, and therefore recite a drive system including, inter alia, a first motor which is a high-efficiency switched reluctance electric motor or a brush-less DC motor. Thus, claim 24 is clearly distinguishable from the cited combination of references. The rejection has been overcome, and reconsideration is respectfully requested.

The Examiner rejected claims 2 and 4 under 35 U.S.C. § 103(a) as being unpatentable over Kawamura in view of Deguchi et al. as applied to claims 1 and 3, and further in view of Arimitsu (U.S. Patent No. 6,376,955). The Examiner asserted that Arimitsu discloses the use of a switch reluctance motor, and that two motors may be rotated independently.

The rejection is traversed. Claim 2 has been cancelled. Additionally, the drive system of claim 4 includes, inter alia, a first motor which is a high-efficiency switched reluctance electric motor or a brush-less DC motor. The deficiencies of Kawamura and Deguchi et al., as discussed above with regard to claims 1 and 3, are not resolved by Arimitsu. Arimitsu describes a

composite motor with two motor units, the first comprising a reluctance motor and the second comprising a synchronized motor. Arimitsu thus simply recognizes that a reluctance motor exists. Applicants find no teaching or suggestion by Arimitsu regarding the use of a brush-less DC motor or a high-efficiency switched reluctance motor in a drive system or in a mower, or regarding the use of two high-efficiency switched reluctance motors or brush-less DC motors as in the present invention. Accordingly, the cited combination of patents does not support a rejection of these claims under 35 U.S.C. § 103(a). Reconsideration is respectfully requested.

Claims 10-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kawamura in view of Deguchi et al. as applied to claim 1, and further in view of Krohling (U.S. Patent No. 4,992,920). The Examiner noted that Kawamura and Deguchi et al. do not disclose controlling the generator through its excitation. The Examiner asserted, however, that Krohling et al. discloses a system in which the generator and motors are controlled by a series of signals.

The rejection is traversed. As discussed above, claim 1 recites a first motor which is a high-efficiency switched reluctance electric motor or a brush-less DC motor , thus overcoming the rejection. Krohling does not disclose a high-efficiency switched reluctance electric motor or a brush-less DC motor, and therefore does not resolve the deficiencies of Kawamura and Deguchi et al. Accordingly, this amendment traverses the rejection with regard to claims 10-20 as well. Reconsideration is respectfully requested.

The Examiner rejected claims 25 and 26 under 35 U.S.C. § 103(a) as being unpatentable over Kawamura in view of Davis as applied to claim 24 above, and further in view of ordinary skill in the art. The Examiner noted that Kawamura and Davis do not disclose the specifications of the inverter output, but asserted that it would have been obvious to one having ordinary skill in the art at the time the invention was made to obtaining an output of a synchronous 11/120 VAC, since it has been held that discovering the optimum value of result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272 (CCPA 1980).

This rejection is traversed. Claim 1 recites a first motor which is a high-efficiency switched reluctance electric motor or a brush-less DC motor. Applicants find no teaching or suggestion by Kawamura and Davis regarding a high-efficiency switched reluctance electric motor or a brush-less DC motor. Reconsideration is respectfully requested.

Accordingly, the rejection of claims 1-27 have been traversed, and reconsideration is respectfully requested. It is believed that the above represents a complete response to the rejections under 35 U.S.C. §§ 102(b), 103(a), and 112, second paragraph, and places the present application in condition for allowance. Reconsideration and an early allowance are requested.

Respectfully submitted,

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VERSION WITH MARKINGS SHOWING CHANGES MADE

In the Claims:

Claims 1, 3, 5, 6, 10-20, 23 and 27 are amended to read as follows:

1. (Amended) A drive system for a mower, comprising:

a first wheel for propelling the mower;

a first motor mechanically connected to the first wheel such that the first motor drives the rotation of the wheel, wherein the first motor is a high-efficiency switched reluctance electric motor or a brush-less DC motor;

a generator electrically connected to the first motor such that the generator converts mechanical power into electrical power and supplies this electrical power to the first motor; and

an internal combustion engine mechanically connected to the generator such that the internal combustion engine supplies mechanical power to the generator.

3. (Amended) The drive system of claim 1, further comprising:

a second motor mechanically connected to a second wheel and electrically connected to the generator such that the second motor drives the rotation of the second wheel, wherein the second motor is a high-efficiency switched reluctance electric motor or a brush-less DC motor.

5. (Amended) The drive system of claim 1, wherein the internal combustion engine is run continually at the speed where it [is most efficient] operates at maximum torque.

6. (Amended) The drive system of claim 1, wherein during braking of the first wheel the [motors] motor will regenerate energy back through the motor to apply a braking force against the internal combustion engine.

10. (Amended) The drive system of claim 1, further comprising:

a power control module electrically connected to the generator, the power control module including a central computer and a generator control circuit, [such that] wherein the central computer is adapted to control the generator [is controlled by the central computer] through the generator control circuit.

11. (Amended) The drive circuit of claim 10, wherein the central computer is adapted to control [controls] the generator output by controlling electrical excitation of the generator through the generator control circuit.

12. (Amended) The drive circuit of claim 10, the generator including a generator rotor and a generator encoder placed to monitor the position of the generator rotor, wherein the generator encoder is adapted to send [sends] a generator signal to the power control module[, and the generator signal is monitored by] such that the power control module is operable to determine a level of excitation required in order to maintain the correct output level of the generator.

13. (Amended) The drive circuit of claim 10, further comprising:

a speed set[-]point signal representing a desired generator speed;

a generator speed signal representing the actual speed of the generator;

a resultant generator error signal representing the difference between the speed set point signal and the generator speed signal; and

a generator control signal;

wherein the central computer is adapted to subtract the generator speed signal [is algebraically summed with] from the speed set[-]point signal to form the resultant generator error signal[, and the resultant generator error signal is processed by the central computer to create the generator control signal which is sent to the generator circuit to control the excitation of the generator]; and

wherein the central computer is further adapted to process the resultant generator error signal to create the generator control signal which is sent to the generator circuit to control excitation of the generator.

14. (Amended) The drive system of claim 1, further comprising:

a power control module including a central computer and a motor control circuit, [such that the motor is controlled by] wherein the central computer is adapted to control the motor through the motor control circuit.

15. (Amended) The drive system of claim 14, the motor including a motor rotor and a motor encoder placed to monitor the motor rotor, wherein the motor encoder is adapted to send [sends] a motor signal to the power control module, and the power control module is adapted to monitor the motor signal [is monitored by the power control module] to determine the level of excitation required in order to maintain the correct output level of the motor.

16. (Amended) The drive system of claim 14, further comprising:

a speed set[-]point signal;

a motor speed signal;

a resultant motor error signal; and

a motor control signal;

wherein the central computer is adapted to subtract the motor speed signal [is algebraically summed with] from the speed set[-]point signal to form the resultant motor error signal[, and the resultant motor error signal is processed by the central computer to generate the motor control signal which is sent to the motor circuit to control the excitation of the motor]; and

wherein the central computer is further adapted to process the resultant motor error signal to create the motor control signal which is sent to the motor circuit to control excitation of the motor.

17. (Amended) The drive system of claim 14, further comprising:

a speed set point signal, wherein the central computer is adapted to determine [determines the speed of the motor] and [to compares] compare the speed of the motor to the speed set point signal to determine if a speed correction is required to increase or decrease the power signal to that motor.

18. (Amended) The drive system of claim 17, wherein the central computer is adapted to control [the] acceleration of the motor [is controlled by ramping up] through increases in the speed set[-]point signal.

19. (Amended) The drive system of claim 14, further comprising:

a current set point signal, wherein the central computer is adapted to determine [determines the current of the motor] and [to compares] compare the current of the motor to the current set point signal to determine if a current correction is required to increase or decrease the power signal to the motor.

20. (Amended) The drive system of claim 14, the power control module including:

[a central computer, which accepts control signals from a steering input device;]

a generator encoder adapted to provide [providing] a generator signal [and motor encoder providing a motor signal, wherein these signals are used by the central computer to control of the commutation of the phase excitation in the generator stator winding and the motor stator winding]; and

a motor encoder adapted to provide a motor signal;

wherein the central computer is adapted to accept control signals from a steering input device; and

wherein the central computer is adapted to control commutation of phase excitation in a generator stator winding and a motor stator winding through the generator signal and the motor signal.

20. (Amended) The drive system of claim 14, the power control module including:

a generator encoder adapted to provide a generator signal; and

a motor encoder adapted to provide a motor signal;

wherein the central computer is adapted to accept control signals from a steering input device; and

wherein the central computer is further adapted to control commutation of phase excitation in a generator stator winding and a motor stator winding through the generator signal and the motor signal.

23. (Amended) The drive system of claim 1, further comprising:

an inverter module connected to the generator to provide external auxiliary power output.

27. (Amended) The drive system of claim 23, wherein the [inverter] external auxiliary power output from the inverter is not provided [may be inhibited] when the mower is moving.